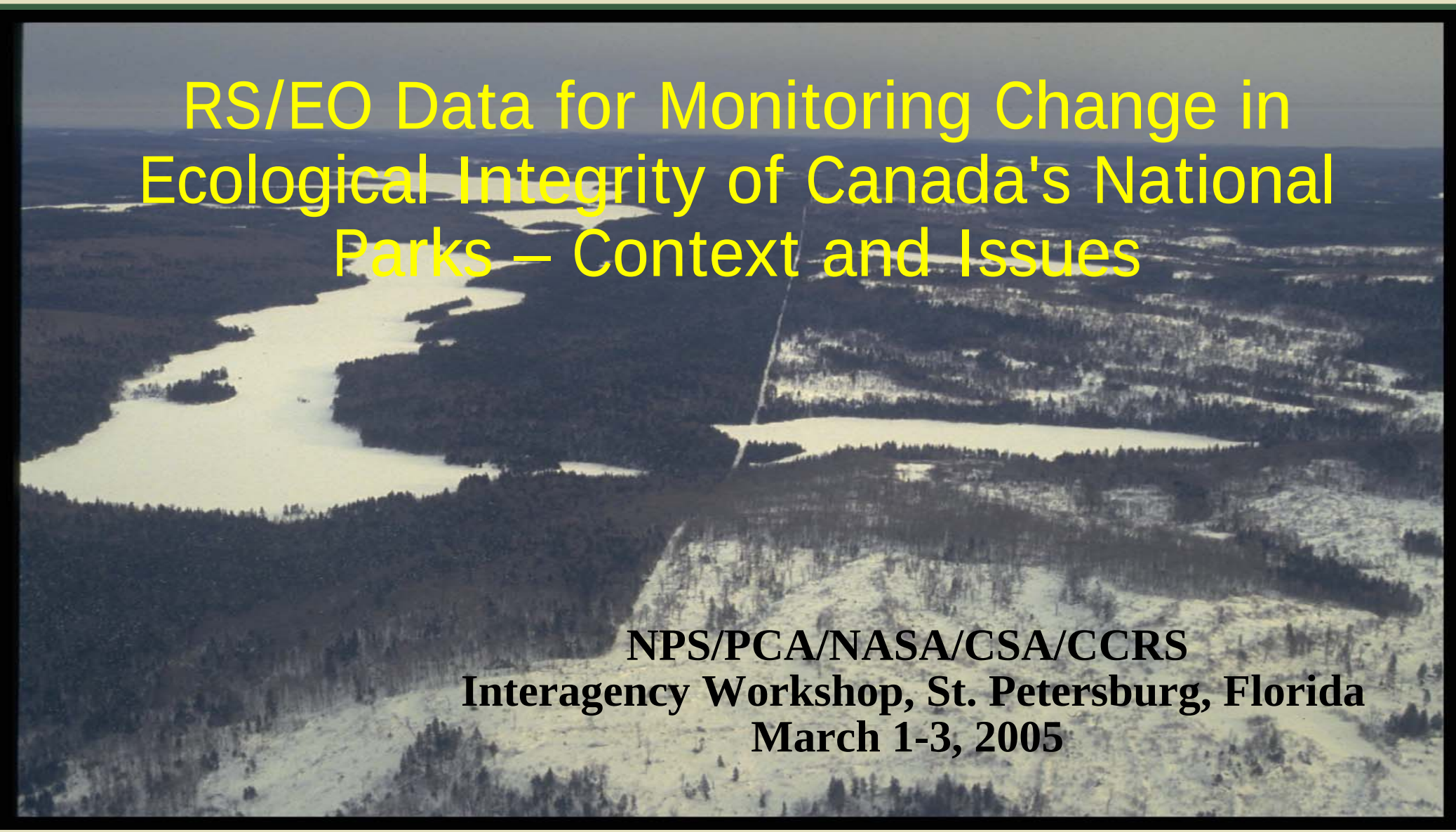


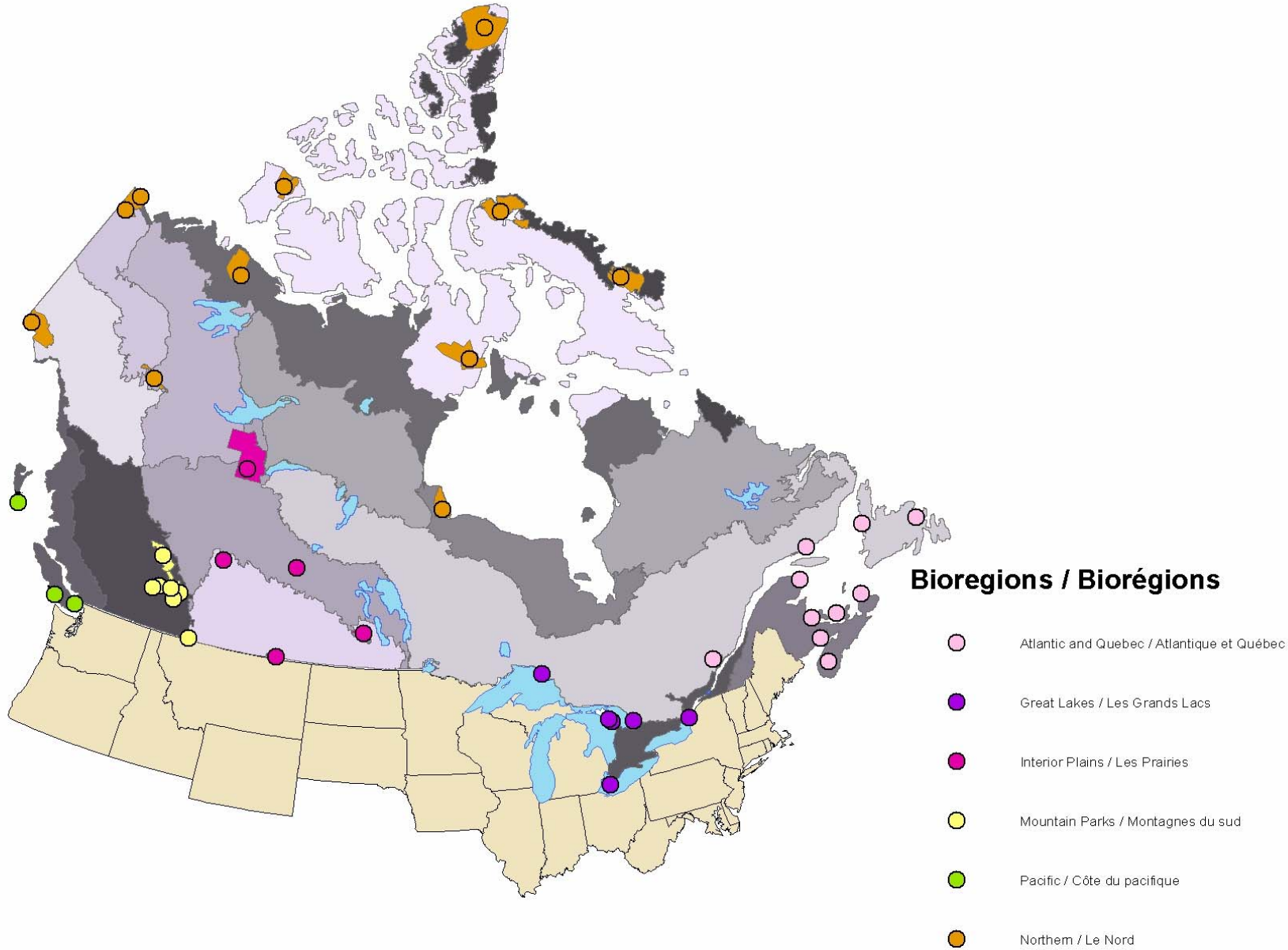
RS/EO Data for Monitoring Change in Ecological Integrity of Canada's National Parks – Context and Issues

NPS/PCA/NASA/CSA/CCRS
Interagency Workshop, St. Petersburg, Florida
March 1-3, 2005

Parks Canada Parcs Canada

Canada

Bioregional Groups of Canada's National Parks by Ecozone
Les groupes biorégionaux des parcs nationaux de Canada, par écozone



February 2004

PCA Legislation

Parks Canada and Ecological Integrity

"*Maintenance or restoration of ecological integrity*, through the protection of natural resources and natural processes, shall be the first priority of the Minister when considering all aspects of the management of parks."

Section 8. (2) Canada National Parks Act (2001)

Ecological Integrity

"….'ecosystem integrity' means, with respect to a park, a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change, and supporting processes".

Section 2. (1) Canada National Parks Act (2001)

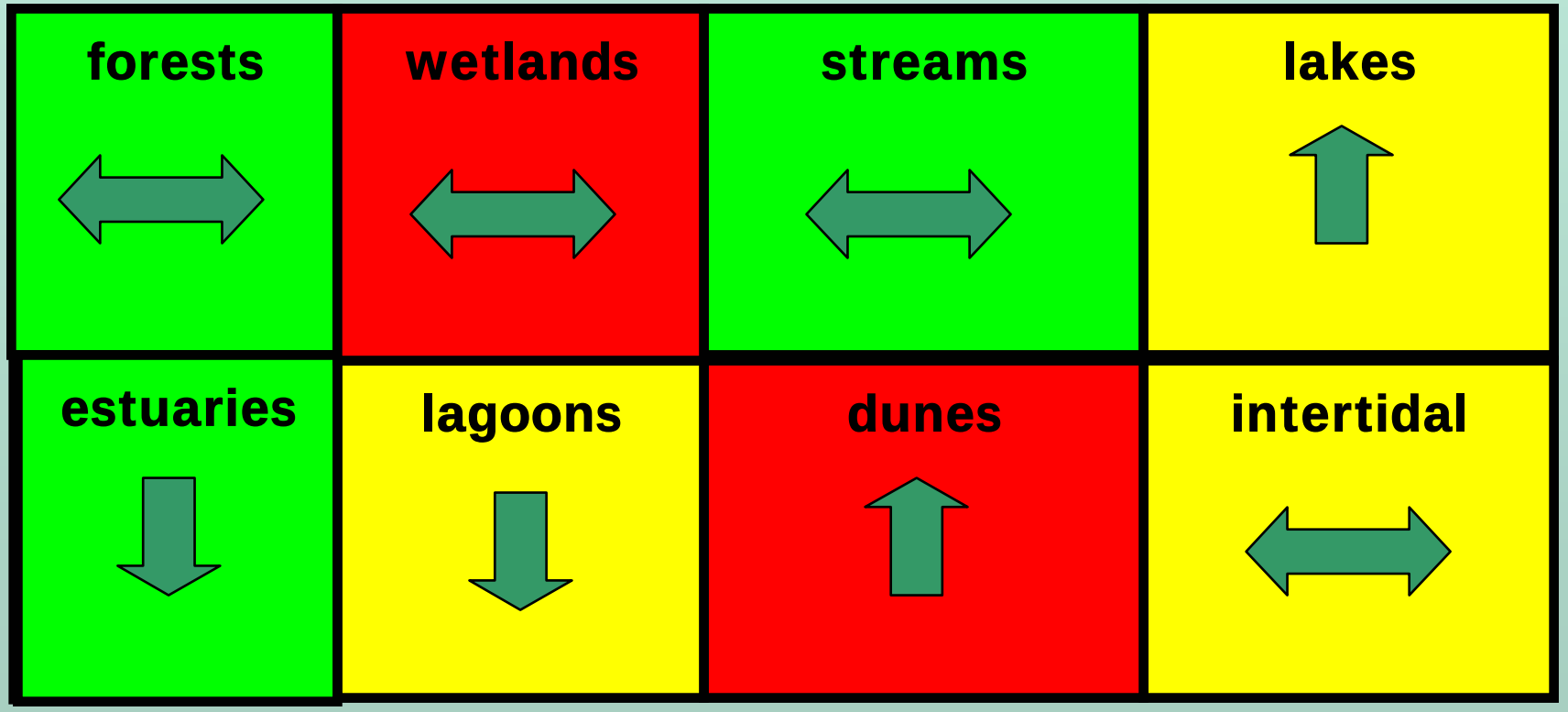
Why Monitor?

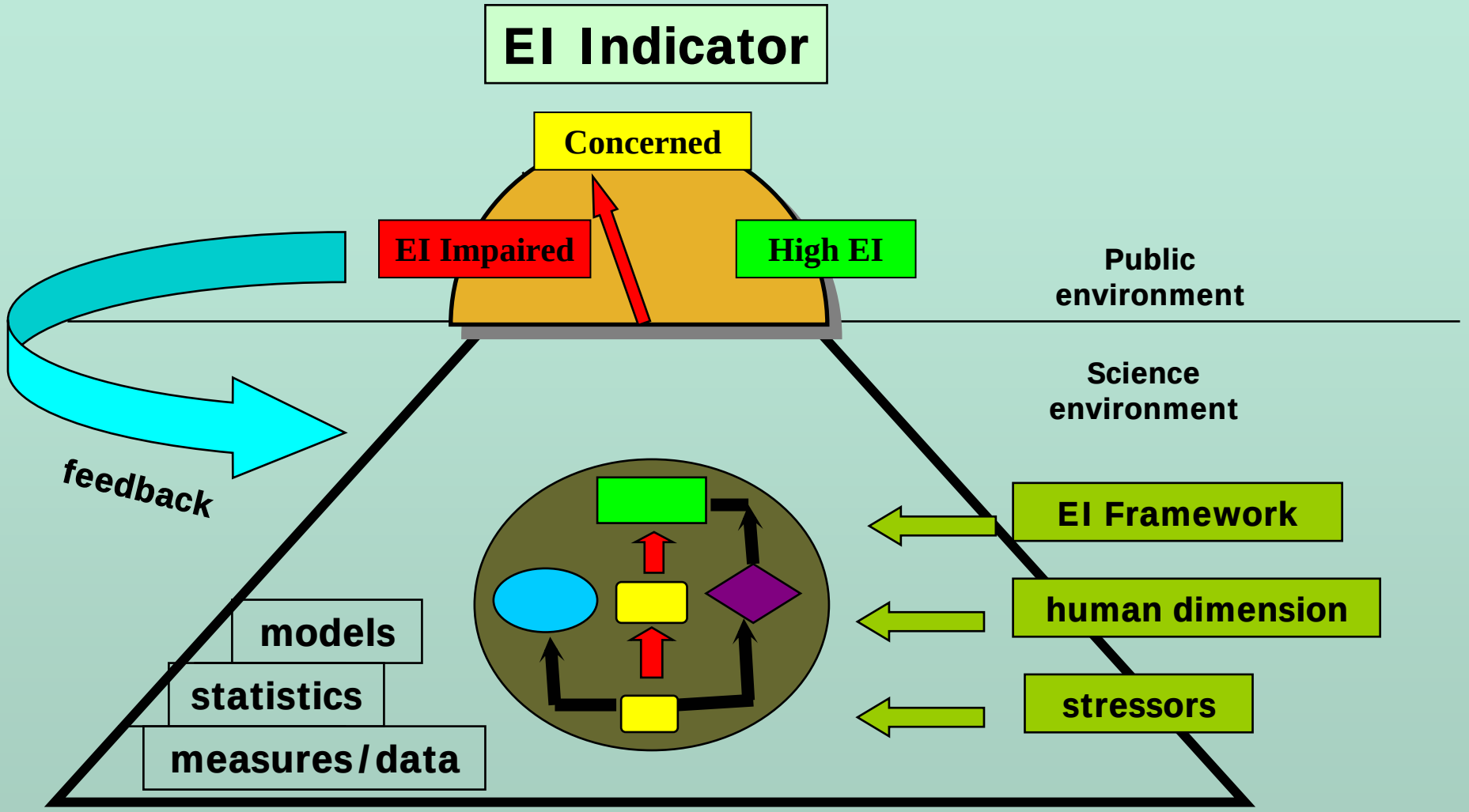
- **All national parks will produce a park**

We monitor so we can provide useful and comprehensive information for park reporting

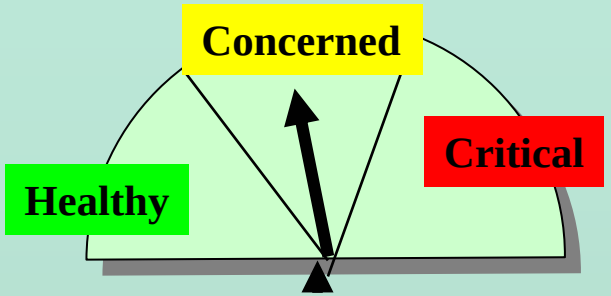
reported to parliament in a State of Parks and Heritage Areas (SOPHA) report

“6-8 Park EI Indicators”




EI Indicator
Concerned
EI Impaired
High EI
Public environment
Science environment
feedback
EI Framework
human dimension
stressors
models
statistics
measures/data

Forest EI Indicator



Stand Level Forest EI

Landscape Level Forest EI

Models

Measures

Data

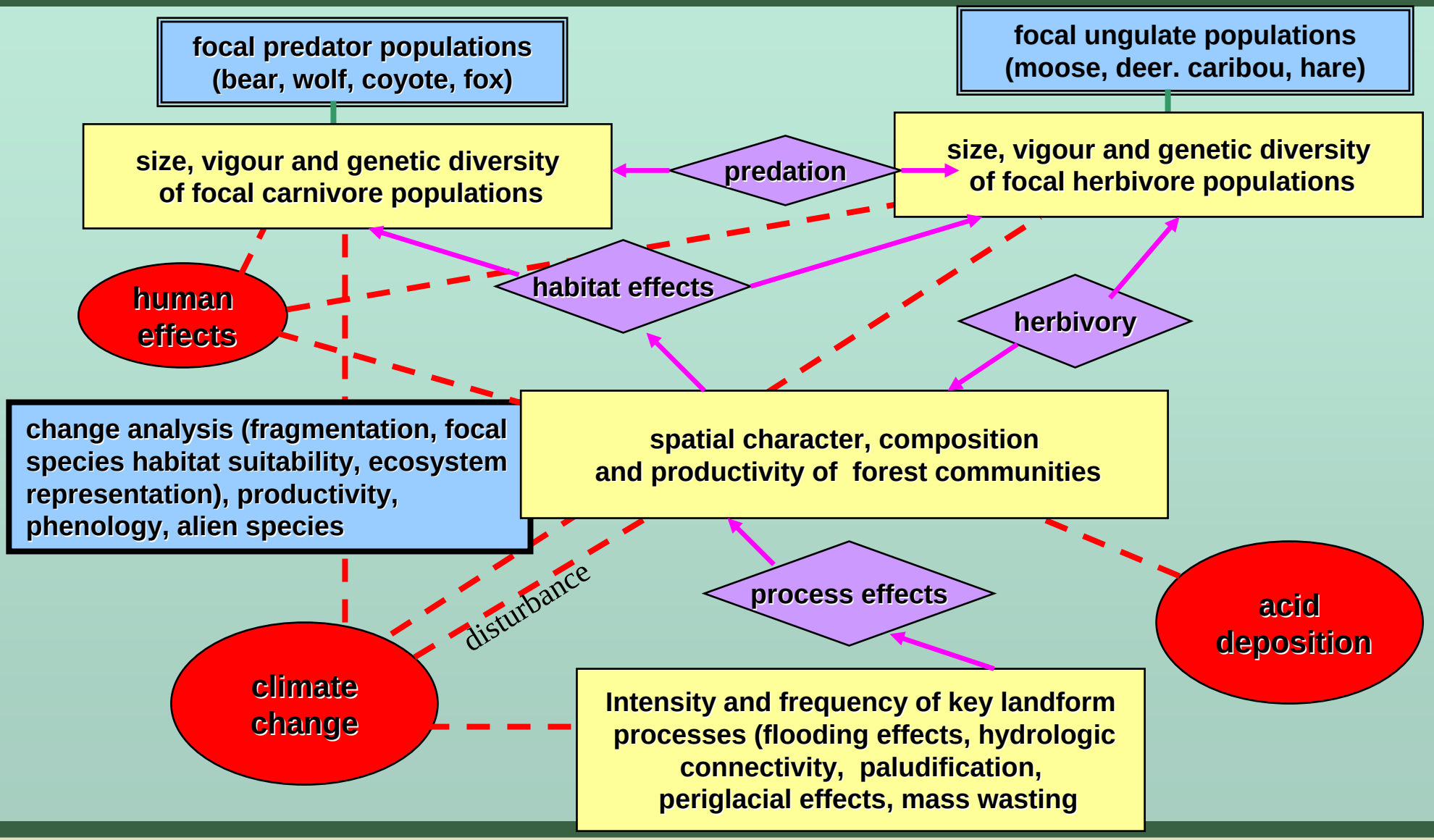
tree productivity, songbird index, salamander populations change, foliar nutrient index, decomposition efficiency

FF BioD Index (SAR, top predators, ungulates), CFBioD Index (ecosystem representation), connectivity, productivity

dbh, canopy condition, species composition, chopstick dry weight loss, songbird/salamander density, relative soil arthropod abundance, foliar nutrient concentrations

SAR and other species population assessments, relative ecosystem abundance, Fragstats, AVHRR

Core Bioregional Forest Landscape Model



Five RS/EO Themes

- Terrestrial ecosystem productivity
- Climate indicators
- Vegetation cover
- Vegetation pattern
- Terrestrial ecosystem disturbance

Terrestrial Ecosystem Productivity Climate Measures

- climate a fundamental determinant of terrestrial ecosystem composition, structure and function
- terrestrial ecosystem productivity directly determined by climate - heat, sunlight, moisture, and nutrients (soil mineral weathering/humus decomposition/nutrient cycling) – climate change imminent
- increases/decreases in productivity will impact fundamental ecosystem processes including growth and reproduction, disease resistance, frost hardiness, forage value, thermal regulation/over-wintering
- phenological interactions – pollinators/flowering phenology, songbirds/insect emergence, raptors/snowmelt/prey availability

Vegetation Cover / Disturbance

- **vegetation component of terrestrial ecosystems constantly changing**
  - **Ecosystem succession** (natural evolution of terrestrial ecosystems)
  - **Ecosystem retrogression** - stand level disturbance effects (natural and human) that interrupt succession and restart succession - fire, windthrow, epidemic insects
- **changes in terrestrial ecosystems impact management of protected areas**
  - **fine filter objectives** (habitat for managed species, e.g., major carnivores and herbivores, species at risk, park headline species)
  - **coarse filter objectives** (ecosystem representation/biodiversity)

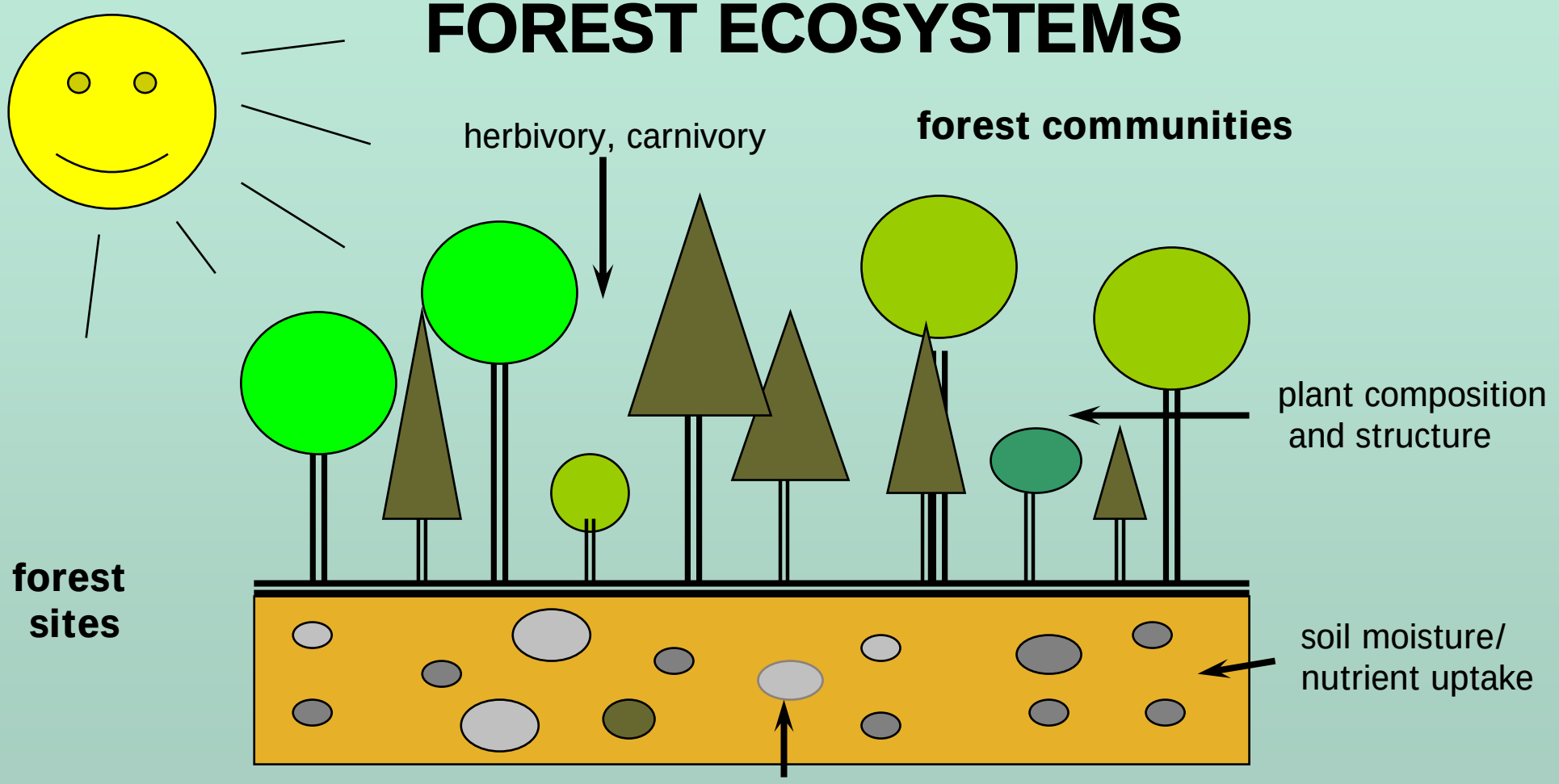
Vegetation Pattern

- **Spatial pattern of forest patches that results from natural and human-caused disturbance has important influence on conservation objectives**
  - Landscape fragmented into a mosaic of forest patches of differing size, shape, structure/age and composition – species' habitat requirements
  - Landscape connectivity – permits/interrupts the flow of species across the landscape - also impacted by 'barriers', i.e., patches of non-forest vegetation (agricultural lands, other land use, roads, urbanization)
- **Spatial pattern adjacent to park compromises objectives within parks**
  - GPE stressors (forest harvesting, agriculture, settlement/land clearance, resource extraction) fragment landscape and impact trans-boundary animal populations

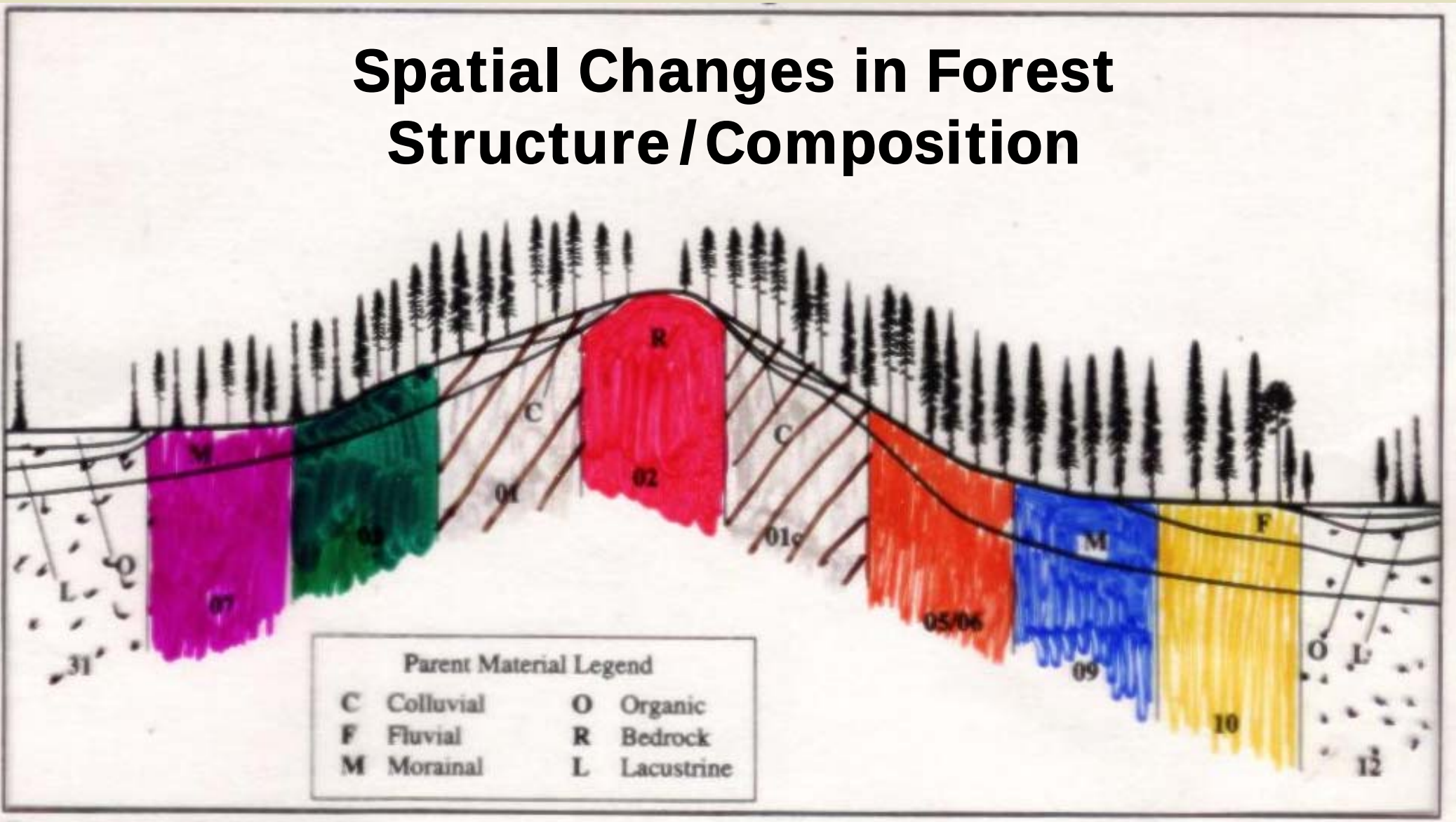
RS/EO and Ecological Scale

- **conservation management must consider a range of biological scales**
  - **genes/individuals/populations/communities/landscapes/watersheds/regions, 'EI … characteristic of it's natural region'**
  - **populations/communities/landscapes are the common conservation management scales – scale 1:15,000 to 1:50,000 – air photos**
  - **land cover from RS/EO typically not enough detail for conservation management, e.g., deciduous, mixed, coniferous cover types may not get at habitat and representation issues**
  - **How to link between scales? – multi-scalar/multi-spectral**

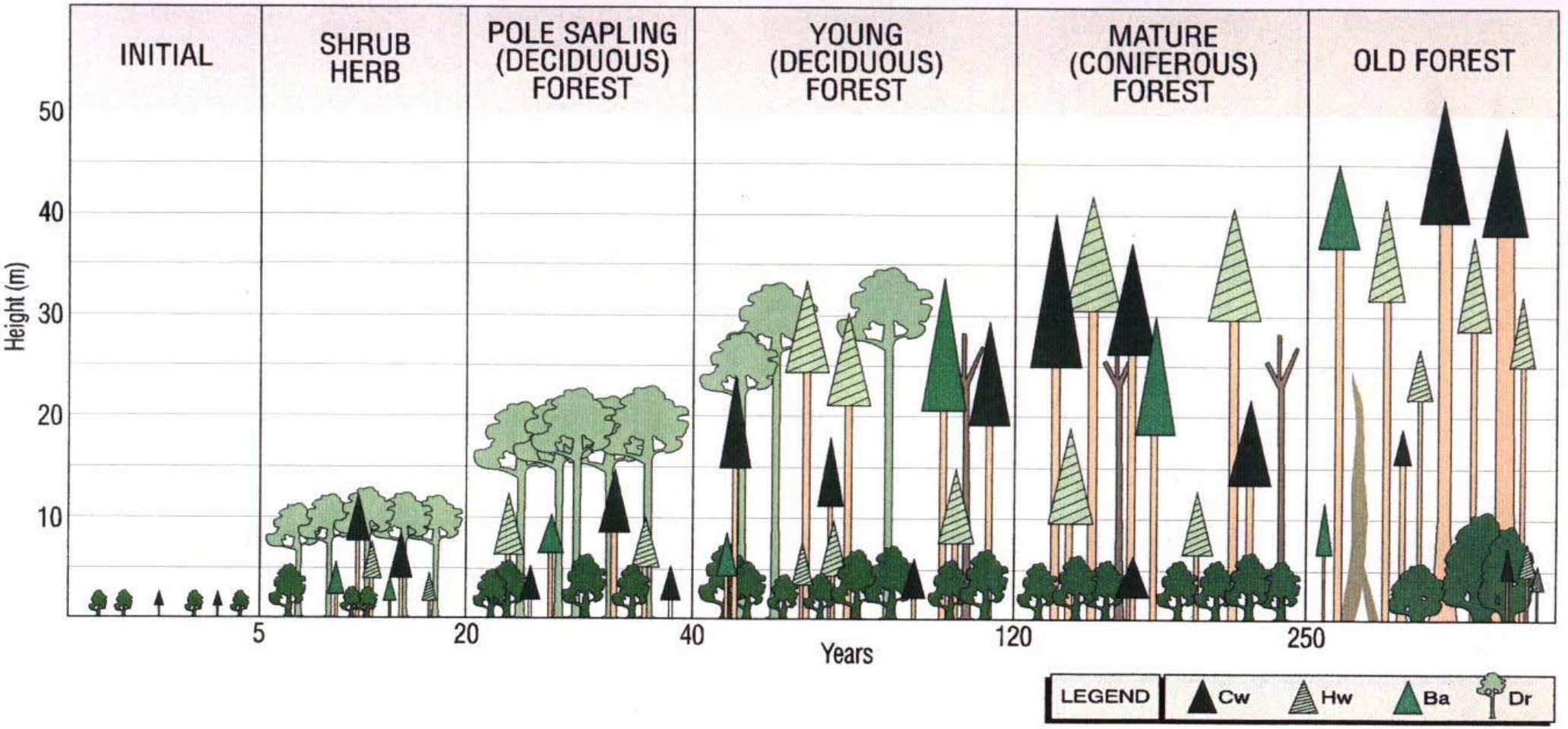
FOREST ECOSYSTEMS



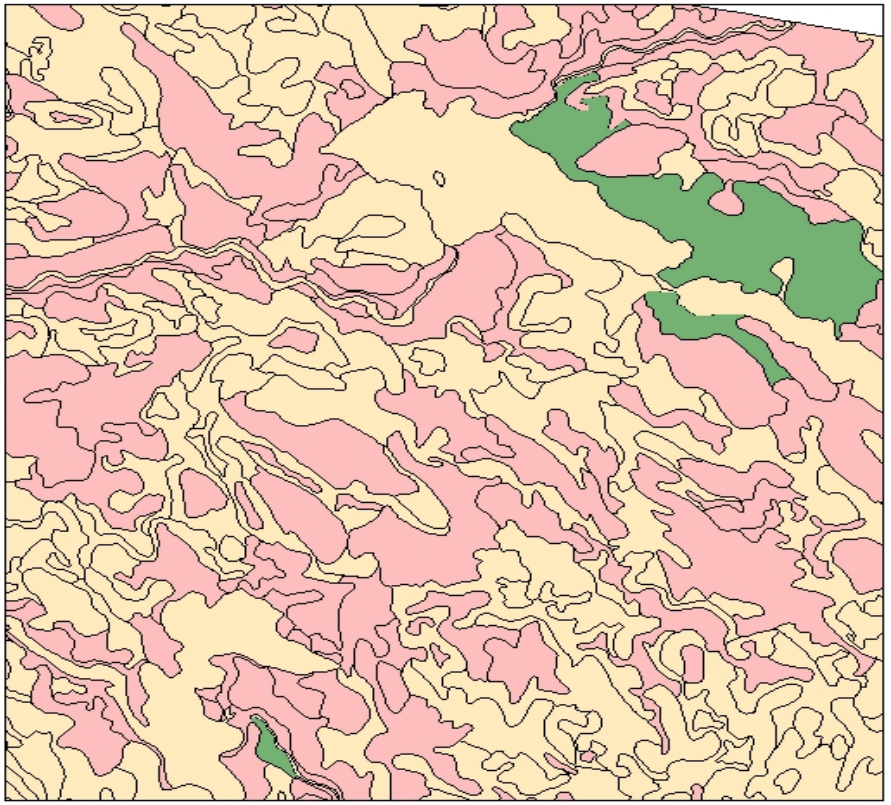
Spatial Changes in Forest Structure / Composition



Temporal Changes in Forest Structure / Composition



Kejimkujik National Park Maple/Oak and Hemlock forest Stands



0 440 880 1,760 2,640 3,520 Meters

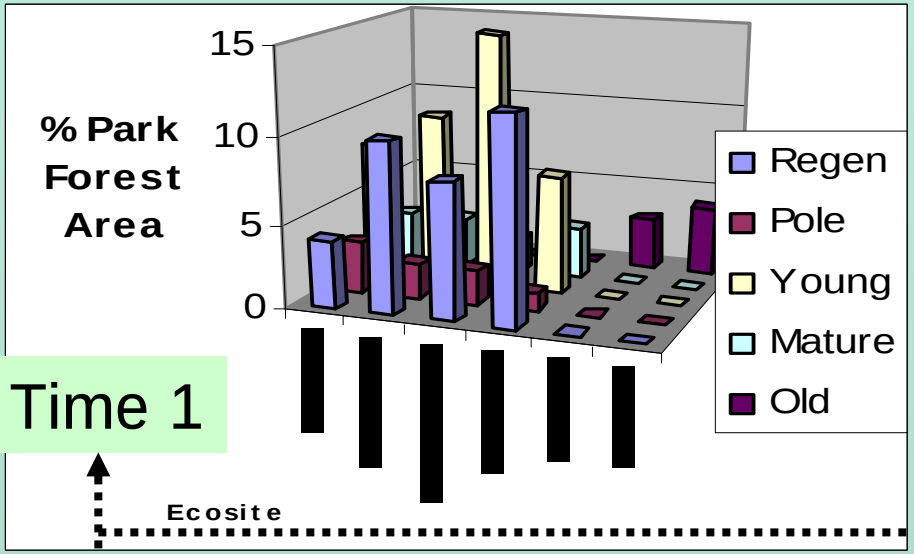
N

Legend

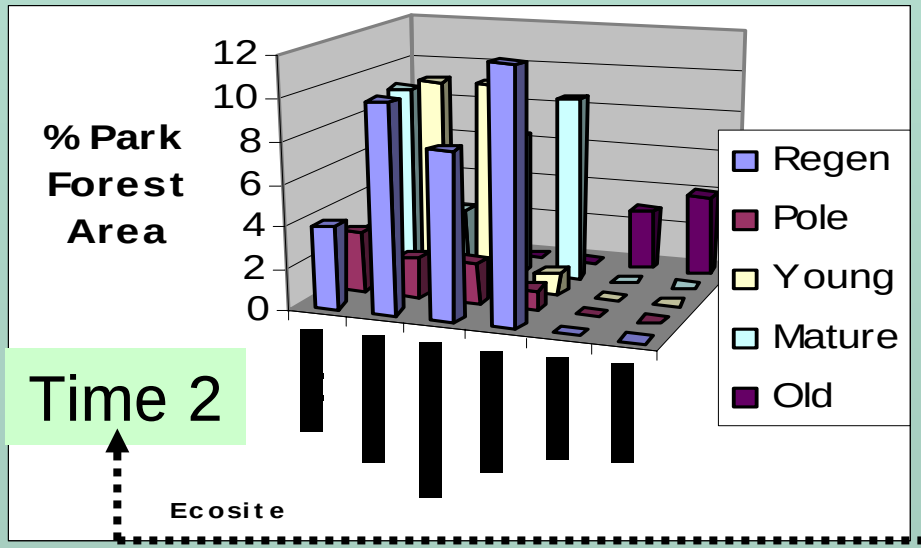
- Maple/Oak
- Hemlock
- All Other Species

Source : Kejimkujik National Park
1972 Biophysical Survey

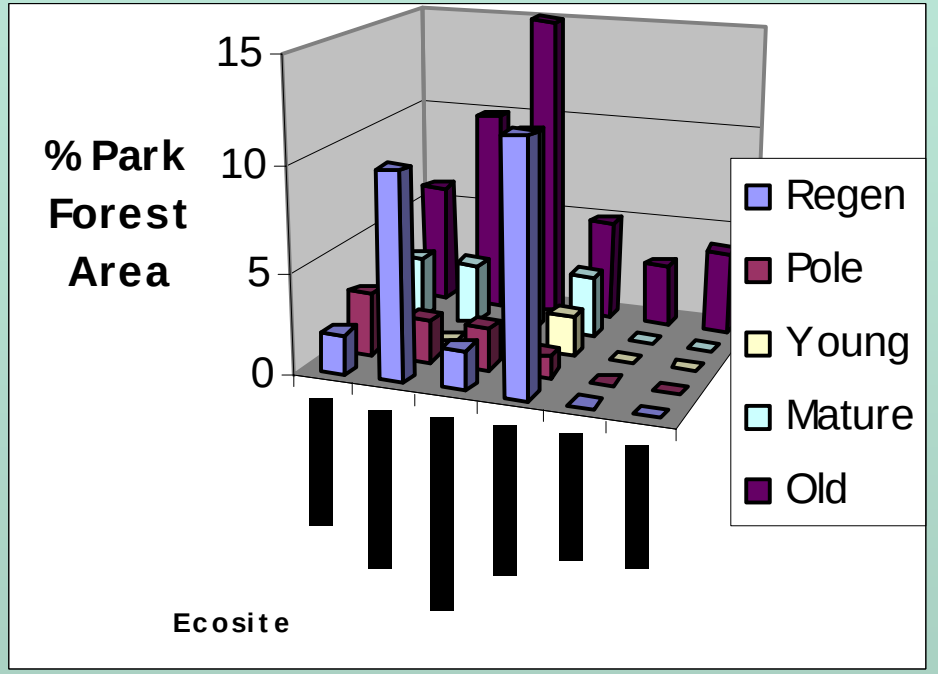
EI Assessment of Change Analysis Data



Time 1



Time 2



Desired Future Condition

RS/EO Issues and EI Monitoring

- Long term monitoring of protected areas requires relevant and repeatable data at a reasonable cost
- RS/EO data will provide important monitoring data for monitoring protected areas– especially in 5 key theme areas
- Park EI monitoring needs:
  - RS/EO monitoring protocols that standardize RS/EO methodologies for measuring EI changes
  - monitoring programs/approaches that link spatial data between high, medium and low resolution RS/EO data sources